FIGHT'S ON!

Quarterly Newsletter from the Warfighter Readiness Research Division (AFRL/HEA)
of the Air Force Research Laboratory Human Effectiveness Directorate

Volume 4, Issue 3
Fall 2004

# Command and Control Environments-- Critical to Distributed Mission Operations

Training research efforts led by AFRL/HEA in the Air and Space Operations Center (AOC) arena will form the foundation of an Air Force (AF) initiative designating a Lead System Integrator with responsibilities for development, logistics, and training. In collaboration with the AF Command and Control, Intelligence, Surveillance, and Reconnaissance Center at Langley AFB VA, AF Warfighting Integration at the Pentagon, and Electronic Systems Center at Hanscom AFB MA, the Lead System Integrator will apply the Division's AOC training research technologies and methods to recommend, maintain, and implement an integrated competency-based training framework.

*An USAFWS Air Battle Manager instructor from the 8WPS monitors a WIC Class 04B student's performance. WIC students controlled teams of Viper pilots during DMO training research scenarios at MRS*

The Division's leadership in Distributed Mission Operations (DMO) training research has helped springboard Mission Essential Competency (MEC) development across a number of weapon systems, roles, and missions. MECs are higher-order individual, team, and inter-team competencies needed by a fully prepared warfighter for successful mission accomplishment under adverse conditions and in a non-permissive environment. MECs, comprised of supporting competencies, knowledge, skills, and experiences, are demonstrated in the context of actual missions or high-fidelity simulated combat missions under wartime conditions. MECs are being used to develop training technologies to support an array of AOC mission challenges, such as the Master Air Attack Plan, Strategy Development, and Time Sensitive Targeting.

A MEC-based approach for AOC operators will lead to more proficient and standardized readiness capabilities in this vital link of the Kill Chain. This approach will also open the door to transition similar training research programs to a number of warfighters in mission areas supporting command and control (C2) functions. Using MECs to define lower-level training requirements, the AOC training research team will develop relevant technologies to address readiness solutions for individual AOC positions and teams.

Team Mesa is building an archetypal AOC environment to aid the development of training tools and techniques. The multifaceted breadth and complexity of AOC operations, however, complicates identifying individual and team-level training requirements. DMO training research programs at Mesa Research Site (MRS) span a wide range of operations, and the Division is leveraging research in the warfare arenas where Air Battle Managers (ABM) ply their C2 knowledge, skills, and abilities.

With the USAF Weapons School (USAFWS) Commandant's seal of approval during an on-site visit, Team Mesa hosted the 8th Weapons Squadron (8WPS) ABM instruc-


*Col John Carter, USAFWS Commandant, flew "his" A-10 to Mesa for a DMO orientation while 8WPS instructors conducted intense training analysis with WIC Class 04B students and supporting Viper pilots from Cannon AFB and Luke AFB*

tors and students of Weapons Instructor Course (WIC) Class 04B for a week of high-fidelity DMO training research scenarios. Supported by two teams of F-16 pilots from the 56th Fighter Wing at Luke AFB AZ and one team of pilots from the 523rd Fighter Squadron at Cannon AFB NM, ABM students controlled the five-ride WIC syllabus missions from the Weapons Control Station (WCS) in the DMO Testbed. Developed from MEC-based scenarios, the WIC syllabus tested each ABM student's ability to operate in a dynamic C2 environment similar to what they encounter in combat aboard Airborne Warning and Control System (AWACS) aircraft.

While the F-16 pilots executed tactics in four Multi-Task Trainer (MTT) Viper simulators, WIC Class 04B students honed their C2 skills under the watchful eyes of 8WPS instructors. As a "first-ever" capability, MRS engineers recorded operator actions from the WCS for audio and video playback during digital debriefings after each mission. For the first time, pilots and controllers saw and heard all the details of each other's actions, as the WCS "scope" appeared on a separate plasma screen near the god's eye view of the air battles and the quad displays from each MTT. Strongly endorsed by the WIC graduates among the teams of pilots and the 8WPS instructors, this debriefing capability greatly enhanced learning for each warfighter and provided unique insights for the research scientists.

The fledgling partnership between Team Mesa and the USAFWS's ABM experts flagged best practices and lessons learned from the intense "4-vs-X" engagements. Missions were captured, edited, and archived in an audiovisual digital database of significant vignettes, and 8WPS instructors identified performance indicators derived from radarscope interpretation and communications analysis of operator actions. AFRL/HEA scientists will analyze these vignettes to spin-off DMO training technologies and methods applicable to a number of ABM and C2 Combat Air Forces weapons systems.

*AFMC test pilots from Eglin AFB and Edwards AFB flew a DMO training research syllabus during a week at MRS, highlighted by an integrated digital debrief capability of all four Viper cockpit systems, "god's eye" view of the engagements, and the Tinker AFB controller's "scope" actions*

The very complex Air Superiority Knowledge Assessment System (ASKAS) for the air-to-air mission has long been under development for Viper pilots at MRS, and the digitally recorded ABM vignettes will support ASKAS for controllers. Designed to be an interactive situational awareness assessment tool, ASKAS for C2 operators will apply methodologies from the ongoing development program. In addition to deriving tasks for ASKAS training research, 8WPS instructors are identifying potential objective measurements for the Performance Effectiveness Tracking System (PETS). PETS extracts 1.7 million data points per minute during training research scenarios in the DMO Testbed, and 8WPS instructors are advising how to enhance the system's ability to objectively measure controller performance.

The ABM experts further helped accelerate DMO training research by teaming with scientists to develop a Pathfinder electronic survey tool to map the degree to which warfighters assess how various pairs of job-specific terms are related. The goal is to measure the degree to which mental models of C2 novices more closely resemble expert models after a week of DMO, and the Pathfinder software output is a mental map showing the relatedness of the items. By constructing MEC-based scenarios in a focused DMO training research syllabus, scientists can use Pathfinder to assess controller progress using enhanced supplemental training methods. With "buy-in" from warfighters, AFRL/HEA scientists, engineers, and subject-matter experts see these research initiatives as keys to improving readiness training for decision makers at every link in the "Image-to-Iron" Kill Chain.

*Mr. Brian Schreiber, lead researcher, describes the PETS program to Commodore Lee Little, Commander, Training Wing SIX, and two USAF instructors assigned to NAS Pensacola*

# DMO Testbed Supports Proof of Concept Collaboration

In collaboration with AFRL's Directed Energy Directorate (AFRL/DE), Team Mesa integrated the High Energy Laser (HEL) Fighter software model into DMO Testbed systems for testing in the four MTTs. This cross-directorate effort is designed to apply DMO training research methods to compress and complement system development by using high-fidelity simulation environments.

AFRL/HEA is assisting in development of the HEL Fighter's employment Tactics, Techniques, and Procedures (TTP) by flying "4 vs X" scenarios in the Viper four-ship loaded with tomorrow's advanced weapon. AF Materiel Command test pilots from Eglin AFB FL and Edwards AFB CA, and pilots of the Air National Guard/Air Force Reserve Command Test Center at Tucson AZ flew sessions during DMO training research scenarios. These pilot teams, graduates of the USAFWS and/or USAF, Joint, and international Test Pilot Schools (TPS), employed the simulated laser weapon in a series of four-ship events to assess the ability of the DMO Testbed to support weapon system development.

With Team Mesa scientists, engineers, and warfighters providing feedback to AFRL/DE, the outcome of the HEL Fighter effort should show the way ahead for streamlining weapon and platform development timelines for other systems, particularly with regard to requirements definition, test and evaluation, concept of operations, and TTPs.

"Hands-on" evaluation by USAFWS and TPS graduates supplement ongoing engineering enhancements to the HEL Fighter software. This relationship facilitates AFRL/HEA's commitment to AFRL/DE to be fully prepared for the first-ever Advanced Concepts Event (ACE) scheduled for November 2004. The ACE event is designed to showcase high-fidelity simulation's ability to assimilate and test futuristic weapons systems in a realistic synthetic environment, and Team Mesa is blazing the trail by learning how best to employ the Viper four-ship armed with the HEL Fighter software load.

## TARGETS OF OPPORTUNITY

After months of scrutinizing simulated radio transmissions culled from tactical engagements flown in the DMO Testbed, Division scientists are on course with Warfighter Communication Assessment System (WCAS) development. Since AWACS accounts for approximately 75% of the voice traffic between airborne assets, WCAS will enable warfighters to determine how in-flight communications affect the outcome of air-to-air engagements.

With subject-matter-expert guidance, scientists built representative samples of audio data captured during DMO scenarios and cleared for unclassified use. These recorded transmissions between Viper pilots and ABM operators will be used to establish a latent semantic analysis tool to mathematically evaluate warfighter communications juxtaposed with ideal "brevity code" phrasing found in AF TTP 3-1 series tactics manuals. This tool will add to the DMO Testbed's ability to support human-centered studies by enabling real-time communication evaluations during training research scenarios and adding an excellent training aid for post-mission analysis. Further, WCAS capabilities can be applied in any combat environment, such as AOC or IO/IW, where specific standards for urgent communications are vital to mission execution.

A voice recognition and speech generation software tool, the Virtual Interactive Pattern Environment and Radiocomms Simulator (VIPERS), will enhance student pilot learning of proper radio procedures required during T-6 "Texan II" aircraft overhead traffic patterns. Air Education and Training Command transitioned this Division-managed research program and established a mandatory addition to the Specialized Undergraduate Pilot Training syllabus. Using intelligent tutoring and cognitive agents, VIPERS will create synthetic teammates, such as flight instructors, supervisors, and other traffic pattern aircraft, to enable tailored student training in pattern operations and radio communications.

Division scientists delivered a working manpower-modeling tool, Mobility Aircraft Availability Forecast (MAAF), for use by Air Mobility Command mission planners. An accelerated research effort, MAAF is designed to estimate maintenance manpower requirements for long-haul airlift missions involving multiple enroute bases. Employed as a decision-support program, MAAF allows mobility planners to use current operations and projected scenarios to ensure assets are in place and on time to support the smooth flow of resources to any forward area.

**AFRL/HEA will demo deployable training systems in Booth 120 at the Interservice/Industry Training, Simulation, & Education Conference 2004, 6-9 December, Orlando FL**

*Col David Gillette, Air Mobility Battlelab Commander, learns more about Experimental Deployable Tactical Trainers from Dr. Wink Bennett. Connected to a robust DMO environment, these systems enable mission rehearsal readiness training for deployed warfighters*

# Training Impact Decision System (TIDES) Simulation Assists Managers

Partnered with AFRL/HE sister research teams in the Warfighter Interface and Information Operations divisions, AFRL/HEA spearheaded the TIDES simulation development to drive training and education planning guidelines for the Information Operations/Information Warfare (IO/IW) communities. TIDES is a tool to optimize career management by balancing occupational training needs against requirements for individuals or groups of individuals. This includes all training, formal (class lectures or laboratories) and informal (self study), as well as on-the-job training for various duties an individual could perform throughout a career.

An early phase of IO/IW training research will use the MEC process to determine subjects to emphasize during training for particular mission areas. TIDES technology allows "what if" assessments of the effects on current and future changes to training, personnel manning, financial policies, and available resources. Once matured, TIDES will enable systematic analyses of integrated information about jobs, tasks, assignments, personnel flows, and training programs. TIDES analyses will also aid decision makers in determining what tasks to train, when to train (at what career points), and what media is best suited for the training.

## BRIEFS AND DEBRIEFS

The Aeronautical Systems Center, Training Systems Program Office (ASC/YW), funded the Division's Night Vision Devices Program to work with Lockheed Martin and partner subcontractors to guide the successful transfer of the Night Vision Goggle (NVG) simulation into the F-16 Mission Training Center (MTC) systems. The NVG simulation features an integrated SensorHost module with the Video Processor for Real-Time Simulation (ViPRS) post-processor, enabling realistic NVG simulation for pilots in simulators.

Delivered to ASC/YW as a technology transition product in 2003, the physics-based SensorHost contains all the lighting calculations and material responses needed to accurately simulate NVG responses to various night sky illumination levels, and uses ViPRS to sense the average scene illumination levels on three different video channels. Under SensorHost control, ViPRS then combines those channels and simulated NVG noise into a single video signal to the pilot's Helmet-Mounted Display. During a demonstration at the MTC Production Preliminary Design Review, representatives from ASC/YW noted the AFRL/HEA team's savvy was a "godsend" to the MTC program.

Maj Gen Marc Rogers, AFMC Director of Transformation (AFMC/TR) learned how technologies and methods evolving from DMO training research have wide-ranging transformational potential, such as expanding to the operational and strategic levels of warfare. Encouraged by MEC-based DMO training applications for the AOC, ABM, IO/IW, and C2 communities, Gen Rogers endorsed the Division's readiness research vector by stressing the need to establish and maintain close contacts with Joint Forces Command, the designated "transformation laboratory" of the United States military.

*Dr. Herb Bell and Dr. Wink Bennett describe the transformation potential of DMO science and technology to Maj Gen Marc Rogers, AFMC/TR*

*Fight's On!* is published quarterly by the Warfighter Readiness Research Division of the Air Force Research Laboratory's Human Effectiveness Directorate, 6030 S. Kent Street, Mesa, AZ 85212-6061.
Visit the Division's website at www.mesa.afmc.af.mil
*Fight's On!* Government Point of Contact: Mr. Jeff Carr, 480-988-6561 x 201, DSN 474-6201, and e-mail jeff.carr@mesa.afmc.af.mil

AFRL/HEA UPAR Case File No. HEA-04-072